

**What is claimed is:**

1           1. An organic device comprising:  
2           a substrate or a dielectric layer;  
3           a photoresist layer formed on the substrate or  
4           dielectric layer, wherein the photoresist  
5           layer is provided with a plurality of  
6           microgrooves having an alignment direction;  
7           an organic semiconducting layer having alignment  
8           formed on the photoresist layer, wherein the  
9           organic semiconducting layer aligns according  
10          to the alignment direction of the microgrooves  
11          of the photoresist layer; and  
12          an electrode.

1           2. The organic device as claimed in claim 1, wherein  
2           the plurality of microgrooves are located in different  
3           regions of the substrate, and wherein the microgrooves in  
4           the same region have the same alignment direction and the  
5           microgrooves in different regions have the same or  
6           different alignment directions.

1           3. The organic device as claimed in claim 2, wherein  
2           the plurality of microgrooves include first  
3           microgrooves aligned according to a first  
4           direction in a first region and second  
5           microgrooves aligned according to a second  
6           direction in a second region, wherein the first  
7           and second directions are different; and  
8           the electrode includes a source and drain, wherein  
9           the source and drain are in contact with the

10           organic semiconducting layer to form a channel  
11           between the source and drain, wherein the  
12           organic semiconducting layer in the channel  
13           region aligns according to the first direction  
14           and the organic semiconducting layer in the  
15           non-channel region aligns according to the  
16           second direction.

1           4. The organic device as claimed in claim 1, which  
2    is a top-gate type transistor and comprises:  
3           a substrate;  
4           a photoresist layer formed on the substrate, wherein  
5           the photoresist layer is provided with a  
6           plurality of microgrooves having an alignment  
7           direction;  
8           an organic semiconducting layer having alignment  
9           formed on the photoresist layer, wherein the  
10          organic semiconducting layer aligns according  
11          to the alignment direction of the microgrooves  
12          of the photoresist layer; and  
13          a source and a drain formed on the organic  
14          semiconducting layer to form a channel between  
15          the source and drain, wherein the channel has  
16          a channel direction the same as the alignment  
17          direction of the microgrooves;  
18          a dielectric layer formed on the organic  
19          semiconducting layer, the source, and drain;  
20          and  
21          a gate formed on the dielectric layer.

1           5. The organic device as claimed in claim 1, which  
2    is a top-gate type transistor and comprises:  
3           a substrate;  
4           a photoresist layer formed on the substrate, wherein  
5                the photoresist layer is provided with a  
6                plurality of microgrooves having an alignment  
7                direction;  
8           a source and a drain formed on the photoresist layer  
9                and being in contact with the microgrooves of  
10          the photoresist layer respectively;  
11          an organic semiconducting layer having alignment  
12                formed on the photoresist layer, the source,  
13                and the drain, wherein the organic  
14                semiconducting layer aligns according to the  
15                alignment direction of the microgrooves of the  
16                photoresist layer, such that a channel is  
17                formed between the source and drain and the  
18                channel has a channel direction the same as the  
19                alignment direction of the microgrooves;  
20          a dielectric layer formed on the organic  
21                semiconducting layer; and  
22          a gate formed on the dielectric layer.

1           6. The organic device as claimed in claim 1, which  
2    is a bottom-gate type transistor and comprises:  
3           a substrate;  
4           a gate formed on the substrate;  
5           a photoresist layer formed on the gate, wherein the  
6                photoresist layer is provided with a plurality  
7                of microgrooves having an alignment direction;

8           an organic semiconducting layer having alignment  
9           formed on the photoresist layer, wherein the  
10          organic semiconducting layer aligns according  
11          to the alignment direction of the microgrooves  
12          of the photoresist layer; and  
13          a source and a drain formed on the organic  
14          semiconducting layer to form a channel between  
15          the source and drain, wherein the channel has  
16          a channel direction the same as the alignment  
17          direction of the microgrooves.

1           7. The organic device as claimed in claim 6, further  
2          comprising a dielectric layer formed between the gate and  
3          the photoresist layer.

1           8. The organic device as claimed in claim 1, which  
2          is a bottom-gate type transistor and comprises:  
3          a substrate;  
4          a gate formed on the substrate;  
5          a photoresist layer formed on the gate, the  
6          photoresist layer is provided with a plurality  
7          of microgrooves having an alignment direction;  
8          a source and a drain formed on the photoresist layer  
9          and being in contact with the microgrooves of  
10         the photoresist layer respectively; and  
11         an organic semiconducting layer having alignment  
12         formed on the photoresist layer, the source,  
13         and the drain, wherein the organic  
14         semiconducting layer aligns according to the  
15         alignment direction of the microgrooves of the  
16         photoresist layer, such that a channel is

17                   formed between the source and drain and the  
18                   channel has a channel direction the same as the  
19                   alignment direction of the microgrooves.

1           9. The organic device as claimed in claim 8, further  
2           comprising a dielectric layer formed between the gate and  
3           the photoresist layer.

1           10. The organic device as claimed in claim 1, wherein  
2           the microgrooves have a depth of 0.3  $\mu\text{m}$  to 1  $\mu\text{m}$ .

1           11. The organic device as claimed in claim 1, wherein  
2           the microgrooves have a width pitch of 0.5  $\mu\text{m}$  to 2  $\mu\text{m}$ .

1           12. The organic device as claimed in claim 1, wherein  
2           the substrate is a silicon wafer, glass, quartz, a plastic  
3           substrate, or a flexible substrate.

1           13. The organic device as claimed in claim 1, wherein  
2           the dielectric layer has a dielectric constant higher than  
3           3.

1           14. The organic device as claimed in claim 13,  
2           wherein the dielectric layer is inorganic material or  
3           polymer material.

1           15. A process for forming an organic semiconducting  
2           layer having molecular alignment, comprising the  
3           following steps:

4           forming a photoresist layer on a substrate or a  
5           dielectric layer;  
6           subjecting the photoresist layer to a  
7           photolithography process through a mask to form

8           a plurality of microgrooves with an alignment  
9           direction; and  
10          forming an organic semiconducting layer on the  
11          photoresist layer having microgrooves, such  
12          that the organic semiconducting layer aligns  
13          according to the alignment direction of the  
14          microgrooves of the photoresist layer.

1          16. The process as claimed in claim 15, wherein the  
2          photolithography process forms a plurality of  
3          microgrooves in different regions of the substrate,  
4          wherein the microgrooves in the same region have the same  
5          alignment direction and the microgrooves in different  
6          regions have the same or different alignment directions.

1          17. The process as claimed in claim 16, further  
2          comprising the following steps:  
3          forming first microgrooves aligned according to a  
4          first direction in a first region of the  
5          substrate, and concurrently forming second  
6          microgrooves aligned according to a second  
7          direction in a second region of the substrate,  
8          wherein the first and second directions are  
9          different; and  
10          forming a source and a drain, wherein the source and  
11          drain are in contact with the organic  
12          semiconducting layer having alignment, such  
13          that a channel is formed between the source and  
14          drain, the organic semiconducting layer in the  
15          channel region aligns according to the first  
16          direction and the organic semiconducting layer

17                   in the non-channel region aligns according to  
18                   the second direction.

1           18. The process as claimed in claim 15, wherein the  
2           substrate is a silicon wafer, glass, quartz, a plastic  
3           substrate, or a flexible substrate.

1           19. The process as claimed in claim 15, wherein the  
2           organic semiconducting layer is formed by deposition.

1           20. The process as claimed in claim 19, wherein the  
2           organic semiconducting layer is formed by vacuum  
3           evaporation, vapor deposition, solution deposition, or  
4           directional deposition.

1           21. The process as claimed in claim 15, wherein the  
2           step of forming the photoresist layer forms the  
3           photoresist layer having a thickness of 0.5  $\mu\text{m}$  to 5  $\mu\text{m}$ .

1           22. The process as claimed in claim 21, wherein the  
2           microgrooves have a depth of 0.3  $\mu\text{m}$  to 1  $\mu\text{m}$ .

1           23. The process as claimed in claim 21, wherein the  
2           microgrooves have a width pitch of 0.5  $\mu\text{m}$  to 2  $\mu\text{m}$ .

1           24. A process for forming an organic device,  
2           comprising the following steps:

3           forming a photoresist layer on a substrate or a  
4           dielectric layer;

5           subjecting the photoresist layer to a  
6           photolithography process through a mask to form  
7           a plurality of microgrooves having an alignment  
8           direction;

9           forming an organic semiconducting layer on the  
10           photoresist layer having microgrooves, such  
11           that the organic semiconducting layer aligns  
12           according to the alignment direction of the  
13           microgrooves of the photoresist layer; and  
14           forming an electrode.

1           25. The process as claimed in claim 24, wherein the  
2           photolithography process forms a plurality of  
3           microgrooves in different regions of the substrate,  
4           wherein the microgrooves in the same region have the same  
5           alignment direction and the microgrooves in different  
6           regions have the same or different alignment directions.

1           26. The process as claimed in claim 25, wherein  
2           the photolithography process includes forming first  
3           microgrooves aligned according to a first  
4           direction in a first region of the substrate,  
5           and concurrently forming second microgrooves  
6           aligned according to a second direction in a  
7           second region of the substrate, wherein the  
8           first and second directions are different; and  
9           the step of forming the electrode includes forming  
10           a source and a drain, wherein the source and  
11           drain are in contact with the organic  
12           semiconducting layer having alignment, such  
13           that a channel is formed between the source and  
14           drain, the organic semiconducting layer in the  
15           channel region aligns according to the first  
16           direction and the organic semiconducting layer



17                   in the non-channel region aligns according to  
18                   the second direction.

1           27. The process as claimed in claim 24, wherein the  
2           substrate is a silicon wafer, glass, quartz, a plastic  
3           substrate, or a flexible substrate.

1           28. The process as claimed in claim 24, wherein the  
2           organic semiconducting layer is formed by deposition.

1           29. The process as claimed in claim 28, wherein the  
2           organic semiconducting layer is formed by vacuum  
3           evaporation, vapor deposition, solution deposition, or  
4           directional deposition.

1           30. The process as claimed in claim 24, wherein the  
2           step of forming the photoresist layer forms the  
3           photoresist layer having a thickness of 0.5  $\mu\text{m}$  to 5  $\mu\text{m}$ .

1           31. The process as claimed in claim 30, wherein the  
2           microgrooves have a depth of 0.3  $\mu\text{m}$  to 1  $\mu\text{m}$ .

1           32. The process as claimed in claim 30, wherein the  
2           microgrooves have a width pitch of 0.5  $\mu\text{m}$  to 2  $\mu\text{m}$ .

1           33. The process as claimed in claim 24, wherein the  
2           dielectric layer has a dielectric constant higher than 3.

1           34. The process as claimed in claim 33, wherein the  
2           dielectric layer is inorganic material or polymer  
3           material.

1           35. The process as claimed in claim 24, wherein the  
2   organic device is a top-gate type organic thin film  
3   transistor (OTFT).

1           36. The process as claimed in claim 24, wherein the  
2   organic device is a bottom-gate type organic thin film  
3   transistor (OTFT).